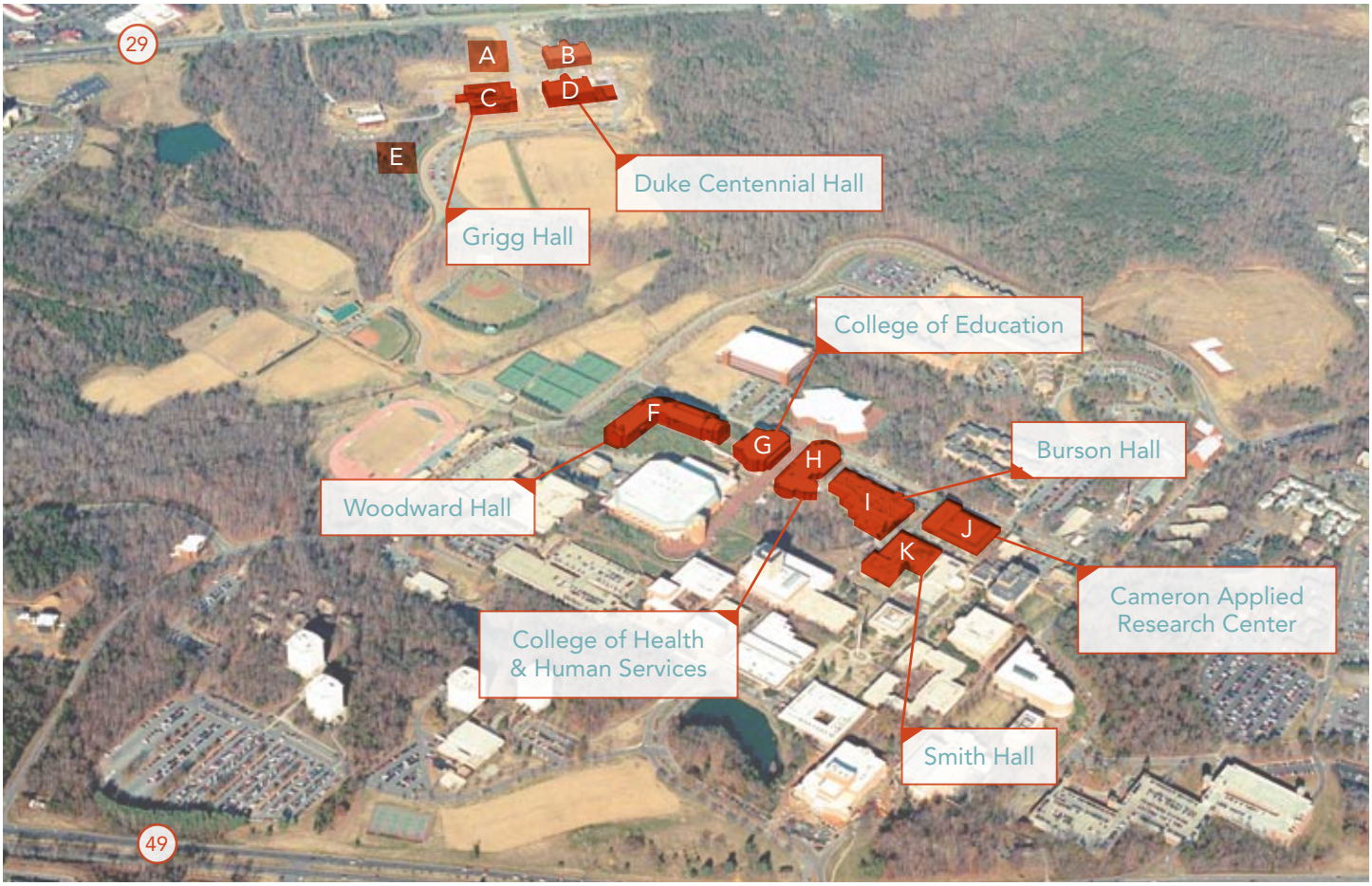
2007-2008

Research Highlights

UNC CHARLOTTE

CHARLOTTE RESEARCH INSTITUTE

Charlotte Research Institute: **A Millennial Campus**



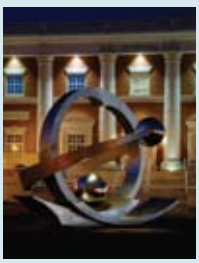
The CRI campus is a geographically defined part of UNC Charlotte known as a Millennial Campus. 2000 State of North Carolina legislation allows partnership activities with private sector partners (including contracts for space use, equipment use, and commercial development). The campus encompasses over 100 acres of land with 8 existing buildings and 4 buildings in planning, design, and construction.

CAMPUS KEY:

- A Future Site of PORTAL Building - Partnership, Outreach and Research to Accelerate Learning
- B Construction underway for Bioinformatics Research Building (opening 2009)
- C Center for Optoelectronics & Optical Communications, Graduate-level Physics, CRI Administration
- D College of Engineering, Center for Biomedical Engineering Systems, Center for Precision Metrology, Department of Mechanical Engineering & Engineering Science, North Carolina Motorsports and Automotive Research Center
- E Future site of Energy Production and Infrastructure Center (EPIC)
- F Department of Biology, Department of Electrical & Computer Engineering, College of Computing & Informatics
- G College of Education
- H College of Health & Human Services, Institute for Social Capital
- I Chemistry, Nanoscale Science
- J Bioinformatics/Bioinformatics Research Center, Civil Engineering
- K College of Engineering

2007-2008

Research Highlights



About the Cover:
In February 2008, the sculpture "Orbis," arrived on the UNC Charlotte campus via Switzerland. The monumental steel design of sculptor, Housi Knecht, popular among captains of industry, was placed on the plaza between Grigg and Duke Halls. This gift was made possible by the generosity of Mr. Irwin Belk.

The Charlotte Research Institute is the portal for business–university partnerships at UNC Charlotte. Regionally, CRI works with the community and the campus to accelerate technology commercialization and the growth of entrepreneurial ventures. Globally, CRI develops intellectual capital through collaborations with industry, government and academia. New business and research ventures, university partnerships, and CRI spin–off companies all draw research and businesses to the region and spur economic growth.

The University of North Carolina at Charlotte continues to grow in enrollment, breadth of academic programs and quality of research. Fall 2008 enrollment exceeded 23,300 and places UNC Charlotte fourth largest among the 17 institutions of the University of North Carolina system. The Charlotte Research Institute is a key component of that growth and connects the business sector to university researchers, talent, and resources. During the 2007-2008 fiscal year CRI hosted thousands of visitors to the campus for facility tours, research collaborations, conferences and technical discussions. These visitors are attracted to UNC Charlotte by the opportunity to collaborate with the outstanding interdisciplinary research centers described in this report. Each of the R&D centers added new faculty researchers during the past year with the largest growth occurring in the Bioinformatics Research Center as the university continues building toward the goal of a 25 person Bioinformatics and Genomics Department.

The front cover and inside front cover of this document illustrate the changing face of the CRI Millennial Campus. The Orbis sculpture, by Housi Knecht, is now featured in the square between Grigg and Duke Centennial Halls in a grassy expanse where students and faculty can admire this beautiful gift to the university and ponder its relationship to the subatomic world or perhaps an astrophysical event. Build out of shell space in Grigg Hall is underway to provide much needed research space for both university researchers and industry partners. Construction of the 97,090sf Bioinformatics building is well under way with plans for occupancy in August 2009. Funding has been received to design and build a 200,000sf home for the Energy Production and Infrastructure Center. Funding has also been authorized for design of the PORTAL building that will complete the quadrangle at the CRI entrance to campus. The Ben Craig Center, a business incubator facility, is now part of CRI and will be relocated to the PORTAL building where additional research and office space will be available for both university and industry researchers. A very significant future impact is the planned extension of the light rail line from uptown Charlotte to the university. Construction is just one sign of the growing research and academic programs at the university.

The growth of research programs and industry partnerships is made possible by the talented faculty, staff and students that bring energy and inspiration to the campus. We cannot recognize all of our many sponsors and supporters in this text but we do give thanks to all who share in this success and look forward to another successful year for CRI, the University of North Carolina at Charlotte and our business partners.

Sincerely,

Robert G. Wilhelm, Ph.D.
Executive Director,
Charlotte Research Institute

2007 Sixth Annual Charlotte Biotechnology Conference

A crowd of nearly 300 attendees packed UNC Charlotte's Barnhardt Student Activities Center last fall to listen and network with the top biotechnology research and business development professionals in the region. "This crowd was the largest that we have ever had in the six years that this event has been hosted by the UNC Charlotte," said Dr. Robert Wilhelm, Executive Director of the Charlotte Research Institute, "this exemplifies the interest and impact that biotechnology is having on the entire Charlotte region."

Conference topics included economic development, university partnerships, the NC Research Campus, biotechnology marketing and branding, business success stories and biotechnology venture capital investing trends. In total, over 35 executives and PhDs spoke at the event.

Also announced at the 2007 Charlotte Biotechnology Conference were the winners of the first annual UNC Charlotte Biotechnology Graduate Student Poster Competition. Fifteen finalists from seven universities competed for $2,000 in cash prizes. Each student had an opportunity to display a scientific poster based on their research. Finalists were interviewed throughout the day by six high profile judges with various scientific, research, investment and business development backgrounds. Posters were scored on three criteria; Scientific Merit (50%), Commercialization Opportunity (30%) and Live Presentation (20%).

Visit: **www.CharlotteBiotechnology.com**

CHARLOTTE BIOTECHNOLOGY CONFERENCE 2007

BIOTECHNOLOGY CONFERENCE WINNERS

Winner ($1,000):

University of South Carolina - Columbia: Brian Furmanski
Developed a simplified, quicker methodology of 2-D electrophoresis for proteonomic studies. Potential licensees are a variety of companies such as pharmaceutical, life science, and environmental companies that are involved in proteonomic studies.

Second Place ($500):

Wake Forest University: Saami Yazdani
Generated bioengineered blood vessels to be used for prosthetic grafts for patients receiving hemodialysis. Potential licensees are companies involved in developing tissue grafts and scaffolds for cardiovascular applications.

Runner Ups ($250 each):

University of North Carolina at Charlotte: Nilay Chakraborty
Technology reduces the cost and ease of cell and tissue banking, a protocol for storage of cells through dry preservation (dehydration) and has application as an alternative to the currently established method of cryopreservation. Potential licensees are any companies involved in cell handling, storage and transport.

Wake Forest University: Alixanna Norris
Isolation of a specific biomarker that can be utilized for diagnosis of prostate cancer in patients who are at high-risk of developing recurrent disease. Potential licensees include companies involved in the production of prostate cancer diagnostic kits.

Left: Dr. Robert Wilhelm, Director of CRI, congratulates Saami Yazdani, winner of the Student Poster Competition.

THE OPEN FOR BUSINESS INITIATIVE ADVANCES IMPORTANT PHILOSOPHIES:

Market Responsive:
Seek out, understand and fill industry needs for knowledge, people and service.

Collaborative:
Work together to solve problems; tear down walls that prevent teamwork.

Efficiency:
Build university systems that emulate smart corporate practices.

Open:
Enable thorough, forward-thinking communications.

Open for Business

"Sit on the same side of the table as industry," defines the Open for Business project at the Charlotte Research Institute. The highly "applied" nature of UNC Charlotte research is a coveted reputation for our creative and diverse professionals. It means we think like our customers. We know their needs and step beyond the campus walls to meet them.

For instance, when it became apparent that no forum existed for life science companies to address R & D trends, we created the "Life Sciences Research Affinity Group" which convenes a wide array of medical research professionals. When the robust hardware resources in our labs were not easily translated by industry, a searchable data base of researchers and hardware was established to help professionals locate the necessary tools and personnel to assist their companies.

Organizations need smart leadership, and Open for Business has refined the practice of building better boards for university centers and institutes. Board members spend more time at "their highest dollar per hour value" when serving on a board that utilizes CRI leadership processes.

Visit: **www.openforbusiness.com**

2008 Seventh Annual Five Ventures® Business Plan Competition and Conference

2008 marked a banner year for the Five Ventures® Business Plan Competition & Conference. What started as a local Charlotte-based competition launched by the **Office of Technology Transfer** seven years ago, has turned into a multi-state program serving early-stage, high-growth companies from throughout the southeast region.

Due to the number of applicants and the quality of the concepts, Five Ventures® split into five competition sectors – Biotechnology, Information Technology, Advanced

BY THE NUMBERS

FIVE VENTURES®

27 Entrepreneur Company Applications

14 Entrepreneur Company Finalists

5 Winners

5 Runner-Ups

120 + Volunteer Coaches, Service Providers, Sponsors and Mentors representing **50 +** companies and organizations.

200 + Conference Attendees

$18,000 in cash awards

$100,000 in direct donated services to winners and runner-ups

Manufacturing, Service/Retail and Student/ Non-Profit. This new model significantly improved the quality of applicants and allowed service providers, mentors and coaches to donate services based upon their strengths and expertise.

Visit: **www.FiveVentures.com**

FIVE VENTURES® COMPETITION WINNERS

Biotechnology

Winner: GOPS Group International
(aka AlgaMax) Develops a system called AlgaMax which takes algae matter and converts it into either a Bio Diesel product or a source to power an energy turbine (called the ProGen) to produce electricity.

Runner-up: VibeTech, Inc.
A medical device development and manufacturing company that produces non-invasive, vibration-based medical devices to reduce or reverse bone and muscle loss associated with aging, disability, injury and reduced activity level.

Advanced Manufacturing

Winner: Filigree Nanotechnology, Inc.
Develops an innovative manufacturing process utilizing silver nanowires which will improve the performance and safety of silver zinc batteries.

Runner-up: VeritasCNC, Inc.
Dedicated to developing next generation products to remedy the current sub-optimal use of tooling and machine tools for computer-controlled machining centers.

Information Technology

Winner: Wisteme
Is a web-based platform where anyone can collaboratively help to build a high-quality, content-rich, question-driven knowledge system by asking, answering, and editing questions.

Runner-up: Jute Networks, LLC
Builds web software that organizes, searches and stores information based on how a user defines a business relationship within a closed and/or shared network.

Service & Retail

Winner: iRealtyManager.com
Provides a set of web-based property management tools that enable real estate professionals (owners, managers & investors) to manage every aspect of their income producing properties via an online interface.

Runner-up: Aretae, Inc. (aka 411Fit .com)
A fitness and health platform that supports students trying to meet fitness and health goals and those whose mission is to help them (nutritionists, personal trainers, and health experts).

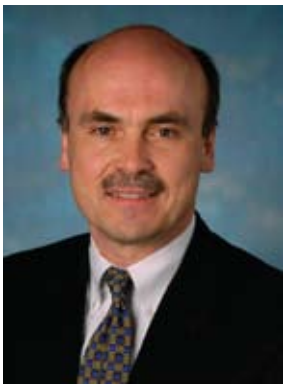
Student & Non-Profit

Winner: Virtual Officer
The use of a virtual human interface to administer police lineups through guided conversation and interactive feedback.

Runner-up: Throwback Sports, LLC
A non-profit business designed to support young athletes and youth teams within the Charlotte region through the acquisition and recycling of gently used, never used or out-dated sports-related items of value.

Ben Craig Center Becomes Part of CRI

During the Fall of 2007, the **Ben Craig Center** moved under the auspices of the Charlotte Research Institute. This change was executed to strengthen the tie between the business incubator facility and campus research activities. While the Ben Craig Center (BCC) refers to a physical location, it is better perceived as an integrated set of services designed to assist client entrepreneurs. These services include a learning community, connections to expert resources, business coaching, engagement with mentors, and specific accounting, finance, and marketing assistance. The BCC also serves entrepreneurs throughout the region with seminars and other educational and networking opportunities. As the BCC becomes more closely integrated with CRI, it will assist technologists with business assessments intended to help bring inventions to market. BCC will engage students and faculty throughout UNC Charlotte, especially the Colleges of Business and Engineering, and encourage entrepreneurial development. BCC, as an entrepreneurial and innovative competency center, will become a resource for CRI activities involving early-stage and high-growth businesses.



Paul Wetenhall was named Executive Director and President of the BCC in May 2008. Wetenhall, was formerly the President of High Tech Rochester, Inc. (HTR), a university based business incubator facility in Rochester, NY. He is a veteran technology entrepreneur and has extensive experience in technology commercialization, innovation, entrepreneurship, and graduate-level entrepreneurial education. He managed HTR's technology business incubator since it opened in 1997, and has recently guided the opening of a bio incubator developed in partnership with the University of Rochester. He has collaborated with academic, economic, and business organizations throughout the nine-county Greater Rochester Region.

The BCC had 16 resident clients as of June 2008 with two companies having graduated during the past year. Another 17 nonresident companies paid for consulting services from the BCC during the 2007-2008 fiscal year. The BCC conducted seven educational outreach seminars this year totaling 200 participants. Plans are underway to design and construct a building on the Millenial Campus that will house the BCC along with researchers from the University and private sector partners. Completion of this PORTAL Building project is anticipated in 2011.

CRI Funds New Seed Research

CRI has created a number of seed grant programs to spur new research directions for UNC Charlotte and our partners. Leveraging National Science Foundation support, CRI supports a joint research program for advanced manufacturing processes that links the Center for Precision Metrology (CPM) at UNC Charlotte and collaborators at Ohio State University.

Seed funds also initiated collaboration between Lee College of Engineering faculty members and research staff at National Gypsum Co. Larger plans are in the works for collaborative medical research that teams basic sciences faculty members at UNC Charlotte with clinical and basic sciences investigators in the Charlotte medical community. The first seed grants will be awarded in December of 2008 with future awards made on a biannual cycle.

Above:
Paul Wetenhall
Executive Director,
Ben Craig Center

Barry Burks Receives 2008 Ray Goertz Award

Long standing American Nuclear Society (ANS) member and former Robotics and Remote Systems Division (RRSD) Chair, Dr. Barry Burks, was presented the Ray Goertz Award for 2008 at the recent RRSD Topical Conference. Dr. Burks is an experimental physicist with over 30 years experience leading research, technology development and systems fabrication projects for the nuclear, waste management and defense industries. In July 2007, he joined the Charlotte Research Institute as Associate Director. The biennial award is the highest honor acknowledged by the division and recognizes ANS Robotics and Remote Systems Division members who have made outstanding contributions in the field of remote technology. It honors the late Raymond C. Goertz for his lifetime contribution to the advancement of remote handling systems and for his development of the master/slave manipulator.

Above: Dr. Barry Burks, CRI Associate Director, receives 2008 Ray Goertz Award.

CENTER FOR LEAN LOGISTICS & ENGINEERED SYSTEMS

Energy Industry Supply Chains Under Study

Increases in global outsourcing activities and high energy costs reinforce the need for efficient business supply chains. Lean logistics and supply chains increase company profit and generate higher value for companies and their customers.

The Center for Lean Logistics and Engineered Systems trains professionals and conducts research to make logistics and supply chain operations lean. The Center studies engineered systems for global supply chain, logistics, and engineering and business operations.

The Center's certificate and continuing education programs help ensure a high quality logistics and supply chain workforce. From an information perspective, the Center's specialized research affects corporate strategy and execution.

For instance, a project with the Electric Power Research Institute studies decision support for the nuclear power industry to advance systems thinking for the next wave of the U.S. nuclear industry.

A project is under way sponsored by the Centralina Council of Governments to characterize the automotive and motorsports industry supply chain in the greater Charlotte region.

Another project with the energy industry investigates logistics and price risk management for global natural gas supply chain operations, specifically the liquefied natural gas supply chain.

Research Funding Tops $35 Million

Overall research funding increased by 7.2%, to $35.6 million. Federal funding increased by 9.2%, to nearly $27 million, and constituted 76% of total funding. Sixty-nine percent of the University's federal funding came from just three agencies: the National Science Foundation (NSF), up 59% to $9.5 million; the Department of Health and Human Services (DHHS), including the National Institute of Health (NIH), up 34% to $5.2 million; and the Department of Defense, up 11.5% to $4.1 million.

The level of NSF funding was our highest ever, and included five active CAREER (Faculty Early Career Development) awards, an ADVANCE (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) award, a GOALI (Grant Opportunities for Academic Liaison with Industry) award, and two REU (Research Experiences for Undergraduates) site awards. In addition, NSF informed us that we would receive funding on two MRI (Major Research Instrumentation) proposals submitted during the past year.

Industry funding was down substantially from the year before, to just over $1 million dollars, but an additional $2.1 million flowed through industry in the form of subcontracts, including $1.9 million in federal funds (counted in the federal total), so our relationship with industry remains strong.

Visit: **www.research.uncc.edu**

RESEARCH AWARDS

	AWARD AMOUNTS				
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**
Federal	16,092,554	18,303,220	25,900,221	24,802,369	**26,984,246**
NC State & Local Gov.	3,384,928	3,788,405	3,559,827	3,004,721	**4,899,686**
Industry	2,677,298	2,667,540	1,561,126	2,783,334	**1,029,588**
Foundation & Other	1,903,690	2,021,244	2,385,349	2,651,564	**2,708,862**
UNIVERSITY TOTAL	24,058,470	26,780,409	33,406,523	33,241,988	**35,622,382**

	AWARD AMOUNTS				
Funding Source	**FY 2004**	**FY 2005**	**FY 2006**	**FY 2007**	**FY 2008**
National Science Foundation	4,794,037	5,207,200	5,309,540	5,945,945	**9,448,658**
DHHS (includes NIH)	3,390,115	3,867,114	4,215,143	3,885,352	**5,207,930**
NIH (alone)	3,225,894	3,785,451	3,911,131	3,359,047	**4,195,142**
Department of Defense	4,149,483	3,370,806	7,905,453	3,641,801	**4,059,908**

From Research to Commercialization

UNC Charlotte's **Office of Technology Transfer** (OTT) identifies, protects, and commercializes university research and intellectual property. For the seventh consecutive year, UNC Charlotte achieved top placement in national rankings published by The Association for University Technology Managers (AUTM) annual survey. The most recent survey statistics show UNC Charlotte ranked number 2 in the nation for patents filed, number 3 in the nation for inventions received, and number 4 in the nation for start-up companies formed in an apples-to-apples comparison (i.e., normalized per $10 million of research expenditures) during fiscal year 2006.

The Office took an active role in commercialization of university technologies and worked closely with the NC General Assembly Funded ACT (Accelerated Commercialization of Technology) Program. The ACT program uses NC State MBA students, a team of interns and business leaders to create viable commercialization strategies for new university technologies. UNC Charlotte's inventions made up four out of the six technologies chosen to be presented by this year's MBA class based on their technical merit and high likelihood of commercial success.

The past year was an exciting time for OTT with the addition of two new staff members. Mr. Carl P.B. Mahler II, J.D., joined the office as the new Executive Director.

Mr. Brad Fach, M.S., M.B.A., joined the office as the new Technology Transfer Associate. Brad is a registered patent practitioner with the United States Patent and Trademark Office and has over seven years of consulting and intellectual property experience with a strong focus in the life sciences.

UNC Charlotte's Office of Technology Transfer was actively involved in the formation of a new university start-up, InfoSense Inc. owned in part by College of Engineering Professor Ivan Howitt. InfoSense utilizes new audio and wireless sensor technology to detect and manage sewer system blockages which are becoming a billion dollar problem in the United States and abroad.

"UNC Charlotte's research strength is one of the best-kept secrets in the state," says Carl Mahler adding "I am extremely pleased to have a chance to work beside CRI in bringing the results of that research into practical application."

This year, OTT signed a record 35 Non-Disclosure Agreements (NDAs) representing university interests. NDAs serve as the foundation for a good working relationship with industry partners. These agreements protect the intellectual property of both parties, allowing for commercialization of discoveries/ inventions that result from collaborative work.

Visit: **www.ott.uncc.edu**

UNC CHARLOTTE'S TECHNOLOGY TRANSFER RATINGS

2006 AUTM Licensing Survey Results:

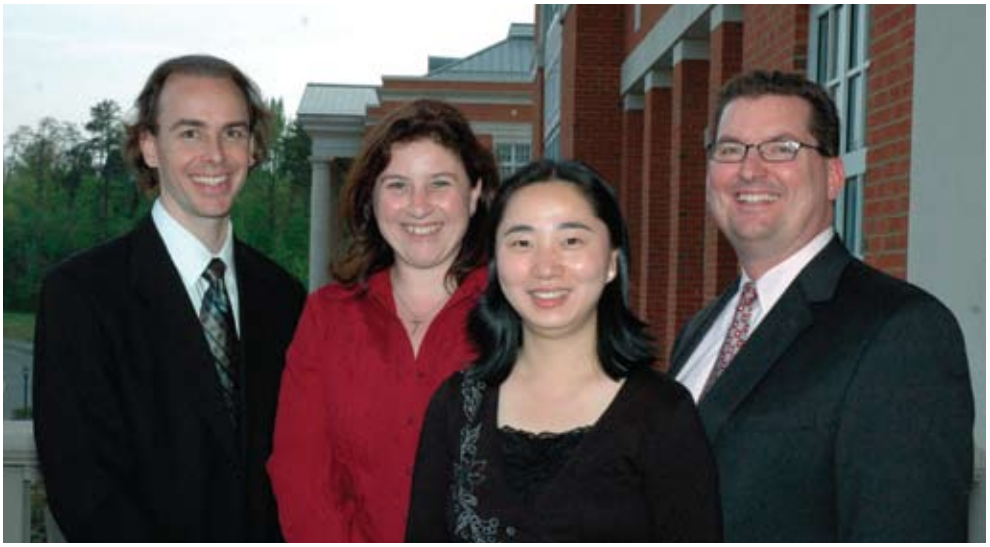
2nd for Patent Applications

3rd for Inventions Received

4th for Start-ups Launched

6th for Patents Issued

Left: Carl Mahler, OTT Executive Director (right) and Brad Fach, Technology Transfer Associate (left).



Brid Mullany and Terry Xu, each received prestigious National Science Foundation Young Investigator Awards.

CPM Staff Win Awards

The **Center for Precision Metrology** is an interdisciplinary association of UNC Charlotte faculty and student researchers located within the Charlotte Research Institute whose mission is to further apply research and technological progress in the field of precision metrology. This field of study includes methods of inspection in manufacturing, the metrology of inspection and production machines, measurement algorithms and tolerance representation, and the integration of metrology into factory-quality systems.

In the 2007-2008 FY the CPM and related faculty provided physical and financial resources for 30 PhD and 32 Master's students to conduct research resulting in the award of five PhDs and ten Master's degrees. CPM researchers received $1.4 million in new grants with $5.3 million continuing from the previous year. The Center's Industry/University Cooperative Research Center program funded 18 projects and added two new members, Moore Nanotechnology Systems and Western Robotics, bringing total industrial affiliates to 13.

Robert Hocken received the American Society of Mechanical Engineers (ASME) Distinguished Service Award, and Scott Smith was made a Fellow of ASME and of the Society of Manufacturing Engineers (SME). Ed Morse received a 3 year appointment to the Sections Board of the Society of Automotive Engineers (SME). Bethany Woody was appointed a Research Affiliate Member of CIRP (The International Academy for Production Engineering). Associated faculty, Scott Kelly,

Associated faculty published 18 peer-reviewed journal articles. One article, "A Double –Pass Interferometer for Measurement of Dimensional Changes," was chosen as a web site 'featured article' by Measurement Science and Technology. CPM faculty submitted 7 invention disclosures and received 3 patents; eight more patent applications were made for previously submitted inventions. Twenty-two presentations were made at technical conferences.

Other Center funding and research collaborators included: UCLA, MIT, Boeing, Lawrence Livermore National Labs, BWXT Y-12, Micro Encoder Inc., Mitutoyo Corp., Caterpillar, Moore Nanotechnology Systems, Corning Cable Systems, National Institute of Standard and Technology, Cummins Engine Inc., United Technologies, Intel Corp., Veeco Inc., Western Robotics, Tianjin University, University of Warwick, Politechnika Lodzka, Kelsey Instrument Company, Tohuku University, Mondragon Unibertsitatea, Technical University of Ilmenau, Universidad de Zaragoza, A*STAR Singapore, and Anna University.

Visit: **www.cpm.uncc.edu**

Above: NSF Young Investigator Award Winners, Scott Kelly, Brid Mullany, and Terry Xu with CRI Executive Director Bob Wilhelm.

Right: Dr. Jerald Overcash at the controls of the sub-atomic measuring machine.

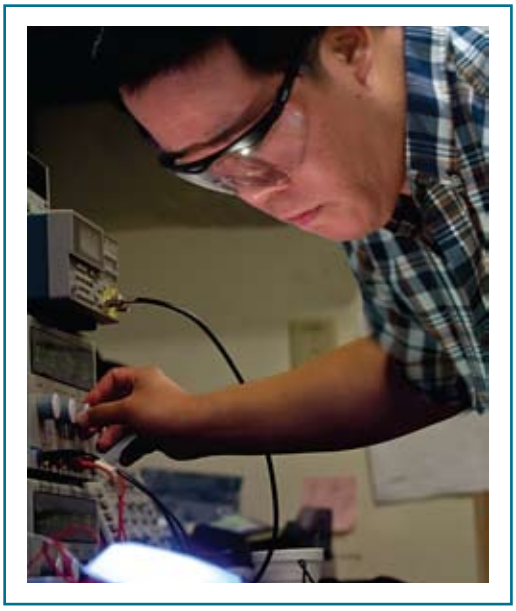
Saving Energy with Photonics

"Photonics," or optoelectronics, is a technological pass-key to save energy, enable more efficient electronics, improve medical procedures and enhance security and defense. The optics field has its own industrial economy that spans the research and manufacturing disciplines.

Our Center builds on existing expertise and facilities in Optoelectronics technology, emphasizing smart integrated optical devices. A key to our success is our interdisciplinary teamwork with metrology, data management and other organizations grounded in materials, processing, fabrication, measurement and characterization. Here are several recent research initiatives:

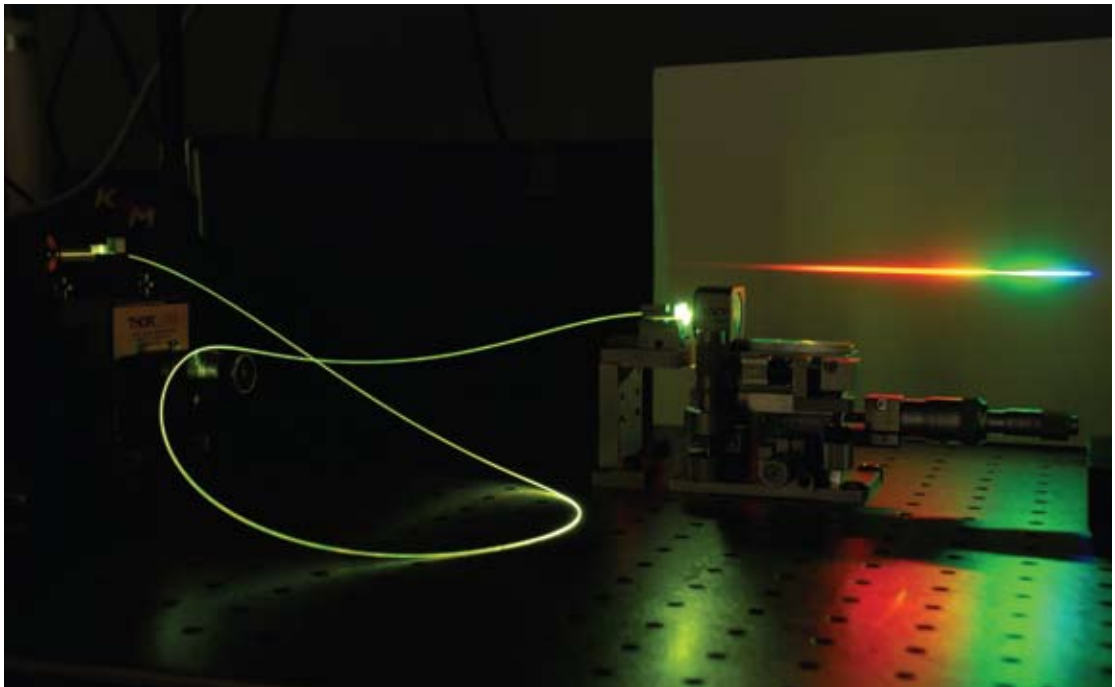
Photonic crystals and nanoparticles are employed to increase the interaction between particles and trapped photons to provide higher nonlinear effects. These effects form the backbone of low noise parametric amplifiers. When successful this provides "cleaner" electronic signals.

New type of silicon-based quantum devices using Gd_2O_3 can be an epitaxial barrier on silicon. Initial results show that it provides an effective energy barrier of >2eV for silicon. With this, it could be possible to induce optical activity for silicon. Normally, because of its indirect energy band gap, electrons in silicon do not interact strongly with light. With this, we could be able to create brighter light with less energy.



CRI is researching the use of high-quality wide bandgap solids, AlN and SiC, for high power, high temperature electronics. Successful research here can lead to highly accurate electronic equipment that can withstand extreme conditions as may be found in desert conditions or outside the earth's atmosphere.

Visit: **http://opticscenter.uncc.edu**

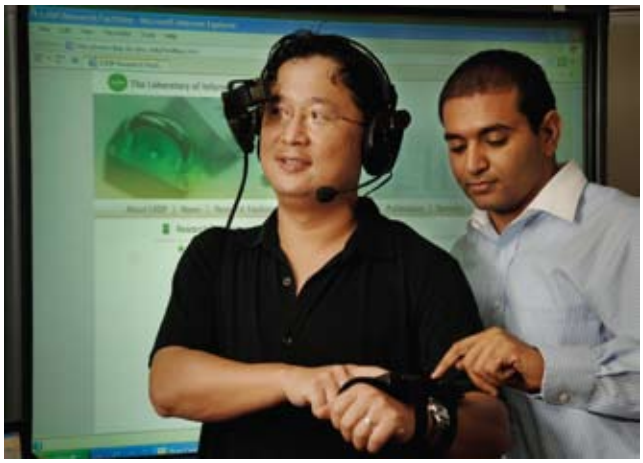


Above: UNC Charlotte Researcher Kien Ly, strives to develop higher efficiency light source.

Left: Supercontinuum (right) the brightest nearly coherent white-light source in the world, is generated from a photonic crystal fiber (left, glowing green) pumped by a Femtosecond pulsed laser.

Ph.D. Program Ranked in Top Ten Nationally

The College of Computing and Informatics (CCI) is a dynamic, exciting, and multidisciplinary educational research institution. It provides academic programs in computer science, software and information systems, information technology, and bioinformatics. It is also the home to leading research centers and institutes, including the **Center for Digital Identity and Cyber Defense Research**, the **Bioinformatics Research Center**, the **Charlotte Visualization Center**, the **Diversity in Information Technology Institute**, and the **Software Solutions Lab**. CCI was established with a vision to be a premier institution of higher learning and research in computing and informatics. The mission of the college is to transform society by advancing computing knowledge and educating future leaders.



Over the course of the last year CCI has had numerous success stories.

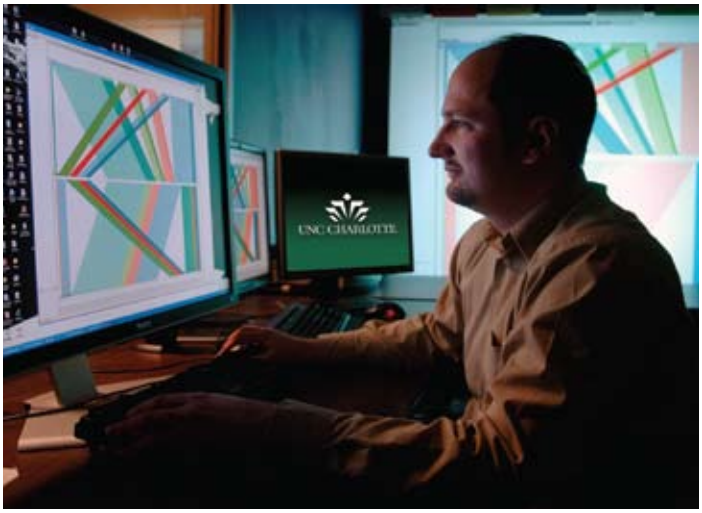
The College's PhD program was ranked tenth in the country by the Chronicle of Higher Education in faculty productivity.

The **Information Assurance Program** became one of the first in the country to be designated by the National Security Agency (NSA) as a National Center of Academic Excellence (CAE) in Information Assurance Research for academic years 2008-2013. The National Security Agency/ Central Security Service is America's cryptologic organization. It coordinates, directs, and performs highly specialized activities to protect U.S. government information systems and produce foreign signals intelligence information.

The **Diversity in Information Technology Institute**, under the direction of Dr. Teresa Dahlberg, received $2.6 million from the National Science Foundation (NSF) to expand the Students & Technology in Academia, Research and Service (STARS) Alliance. STARS is a consortium of 20

Above: PhD student Moonam Ko with researcher Mohammed Shehab.

Right: UNC Charlotte Visualization Laboratory



The **Charlotte Visualization Center (VisCenter)** continues to receive outstanding external funding for its research (over $3.25 million for the past two years). Current funding comes from NSF, Department of Energy (DOE), National Institute of Justice, Army Research Office, U.S. Department of Transportation, Department of Homeland Security (DHS) and other agencies. Major funding from DHS supports the **SouthEast Regional Visual Analytics Center**, housed in the **VisCenter**, in its mission to support investigative analysis throughout DHS and at other government agencies.

The College hosted the 7th annual Cyber Security Conference; the inaugural ScienceFIRST (Future Innovations: Redefining Society and Technology) with a keynote address from the director of National Geographic and IBM's Genographic Project, Dr. Spencer Wells; the "Visualization in the World" symposium; and a two-day interdisciplinary conference examining the behavioral and technological aspects of computer crime.

Ground was also broken on the new 97,090 square foot building that will house the **Bioinformatics Research Center (BRC)**. The **BRC** is also developing a **Center of Excellence in Bioinformatics** at the North Carolina Research Campus at Kannapolis.

Visit: **www.cci.uncc.edu/coit_new/site/index.cfm.**

southeastern universities and colleges and over 80 regional partners with a mission to broaden participation in computing (BPC). The STARS Alliance is the first NSF BPC alliance to receive extension funds, bringing their total NSF support to over $4.8 million from 2006-2011 and establishing UNC Charlotte as a national leader in research addressing the critical national need for a larger, more diverse computing workforce.

CCI has worked extensively with the Defense Advanced Research Projects Agency (DARPA), the central research and development agency for the Department of Defense (DoD), on a social computing project that will substantially enhance the capabilities of the country to understand both short and long-term consequences of events throughout the world. It has also dedicated significant time and resources in working with the DoD on technologies that are useful to the country's military capabilities in the areas of computation and simulation.

Above: Dr. Robert Kosara demonstrates a visualization tool for exploring parallel sets.

Left: Virtual Reality research at the Future Computing Lab.

UNC Charlotte Plans Nation's Largest Bioinformatics and Genomics Department

UNC Charlotte's **Bioinformatics Research Center (BRC)** defines bioinformatics as the "discovery, development and application of novel computational technologies to help solve important biological problems." **BRC** is an interdisciplinary center involving faculty from Computer Science, Biology, Chemistry, Physics, Mathematics and Statistics, and Software and Information Systems. With nine faculty members on staff and plans to hire an additional fourteen over the next two years, the **BRC** plans to build the country's largest bioinformatics and genomics department.

The **BRC** facility, currently under construction, is located on the Millennial Campus of UNC Charlotte. The $35 million, 97,090 square foot facility will include both wet and dry laboratories, as well as core facilities for gene expression, proteomics, microscopy, crystallography and computing. The opening is scheduled for late 2009.

In January 2008, **BRC** opened a satellite Center of Excellence in Bioinformatics on the North Carolina Research Campus (NCRC). This Center will provide specialized computer systems and software, data management solutions and analysis for academic researchers and biotechnology companies. In this role, **BRC** will offer sophisticated computational support in the design and development of new research and technologies.

Dr. Ann Loraine was the first faculty member to arrive at NCRC in February, 2008. An Associate Professor in Bioinformatics, Dr. Loraine's focus will be on using gene expression and other genomic data to characterize regulatory and metabolic networks in plants. She also heads a project funded by the National Science Foundation that will create visualization and data distribution software for Arabidopsis, a "model" plant used to study the many aspects of plant biology.

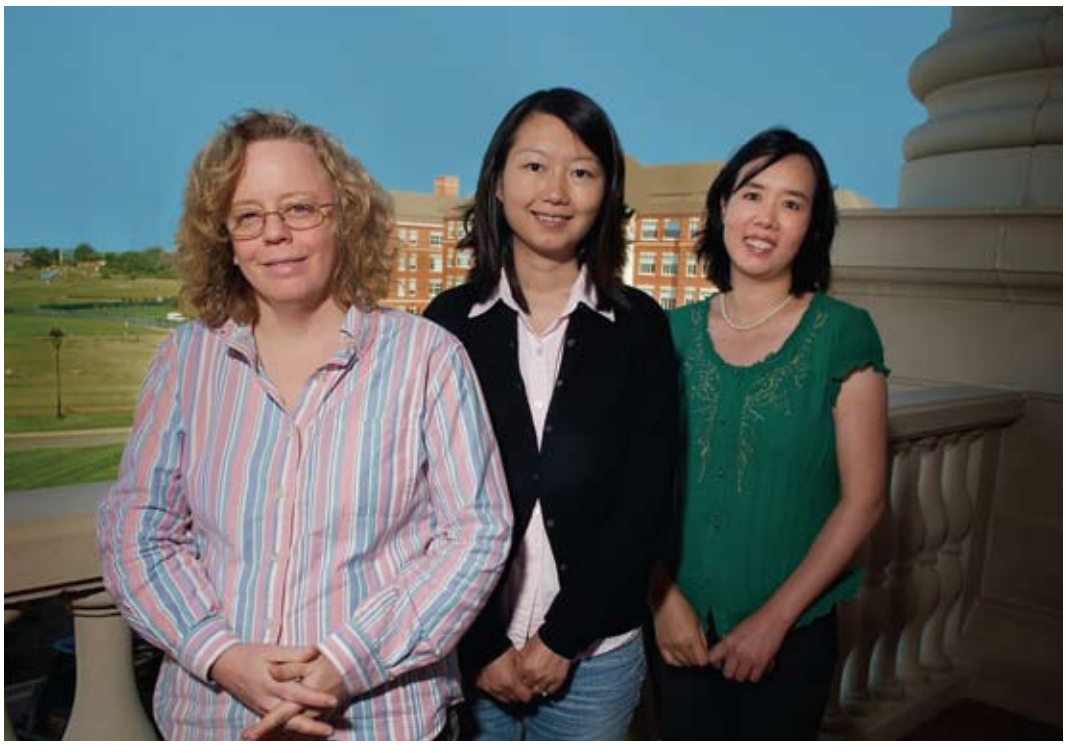
Above: Construction of the Bioinformatics Research Center, viewed between Grigg and Duke Halls, on the UNC Charlotte Millenial Campus.

Joining Dr. Loraine at NCRC is Dr. Wei Sha. Dr. Sha is a research associate at the **BRC**. She has been trained as both a biologist and a bioinformatician. She has broad interest in applying and developing computational methods in understanding experimental data, especially the microarray, proteomics and metabolomics data.

Dr. Xiuxia Du arrived in August. Dr. Du received the Ph.D. in Systems Science and Mathematics from Washington University in St. Louis in 2005. She subsequently did a postdoc in Dr. Richard D. Smith's lab at the Pacific Northwest National Laboratory. Dr. Du's research interests are in bioinformatics for mass spectrometry-based proteomics, metabolomics, lipidomics, and interactomics. Specifically, she focuses on: (1) the development of algorithms to identify protein-protein interactions using mass spectrometry and chemical crosslinking; (2) statistical analysis (e.g. estimation of false discovery rate) of peptide and protein identifications; and (3) the development of algorithms to analyze time-course data. Dr. Du is also interested in conducting systems level analysis of the dynamics of biological systems using genomics data to facilitate studies of the mechanisms of normal and abnormal biological functions.

The Center of Excellence in Bioinformatics will be located on the third floor of the David H. Murdock Research Institute on the North Carolina Research Campus expected to open Fall of 2008.

Visit: **www.coit.uncc.edu/bioinformatics/site/**



Left: Three new UNC Charlotte researchers, Dr. Loraine, Dr. Sha and Dr. Du, will be located at the North Carolina Research Campus in Kannapolis.

NCRC Core Lab Construction Complete

The **North Carolina Research Campus (NCRC)** is a private-public venture created to foster collaboration and further advancements in the fields of biotechnology, nutrition and health.

The campus is the vision of private investor, David H. Murdock, owner of Castle & Cooke, Inc. and Dole Food Company, Inc. With intensive planning and development and Mr. Murdock's investment of over $1.5 billion, NCRC combines all the right elements for breakthrough science and discovery.

Global in scale, **NCRC** will bring together many of the world's top scientific minds with many of the nation's top research universities. With the opening of the Charlotte Research Institute (CRI) satellite office at NCRC in 2006, UNC Charlotte became the first university partner to have a physical presence on the campus. Duke University, UNC Chapel Hill, NC State University, UNC Greensboro, North Carolina A & T State University and North Carolina Central University have followed, with others still expected.

Focused on becoming the world's epicenter of nutrition and disease research, NCRC will offer more than a million square feet of state-of-the-art lab and office space. CRI will be located in the David H. Murdock Research Institute (DHMRI). Also housed there will be a collection of the world's most advanced scientific equipment, including state-of-the-art technology in genomics, proteomics and metabolomics.

CRI also partners with NCRC developer Castle & Cooke North Carolina to recruit and develop biotechnology companies for the campus. Since UNC Charlotte is the closest university to the NCRC, CRI is a significant business partner resource for prospective company recruits.

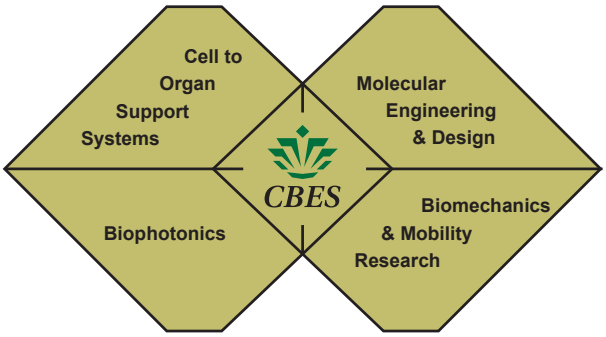
With more than 4,000 graduates each year, UNC Charlotte will also produce many scientific and health industry workers for **NCRC**.

Visit: **http://www.ncresearchcampus.net**

Above: Three buildings near completion of NCRC: UNC, NC State, and Core Lab buildings.

Left: Pristine wet labs ready for researchers.

CBES Continues Mission to Advance Critical Biomedical Technologies



During the last academic year, the 35 affiliated researchers of the **Center for Biomedical Engineering Systems (CBES)** have continued to move forward in fulfilling the **CBES** mission of solving critical biomedical problems using a collaborative approach.

One of the projects ongoing within the Biophotonics Focus Area of **CBES** involves preservation studies of cells, or putting living cells into "suspended animation." An aspect of this research involves loading cellular protectants like the sugar molecule trehalose, to increase the viscosity of the cytoplasm in preparation for preservation processing. As the temperature of the cell is lowered (cryopreservation) or water is removed (anhydrous preservation) the cytoplasm becomes increasingly viscous, thereby preventing damaging chemical reactions from occurring. Ultimately the goal is to create a non-equilibrium solid material (a glass) that can enable long-term storage. The Biometrology group is studying the uptake and distribution of sugars within the cytoplasm of cells using fluorescence anisotropy techniques. The preservation of cellular integrity and function is a critical component of translating scientific advances in tissue engineering and cell-based biosensor development into usable products.

The group members include Dr. Gloria Elliott from the Mechanical Engineering Department, Dr. Stuart Smith from the Mechanical Engineering Department, and Dr. Patrick Moyer from the Department of Physics and Optical Science. Dr. Elliott is a biopreservation expert. Her expertise includes the study of cell engineering via the modification of the intracellular matrix in non-destructive ways. Dr. Smith is a precision metrology and optomechanical instrumentation expert with experience in the design of atomic scale translation stages. Dr. Moyer has experience with the design and implementation of laser imaging and spectroscopy systems with particular emphasis on nanotechnology applications.

Visit **www.CBES.uncc.edu**.

Left: Biophotonics graduate students, Wes Parker (left), and Feilong Lin (center) discuss details of a laser imaging cell experiment with postdoctoral researcher, Hyejim Kim (right), in Dr. Patrick Moyer's laboratory.

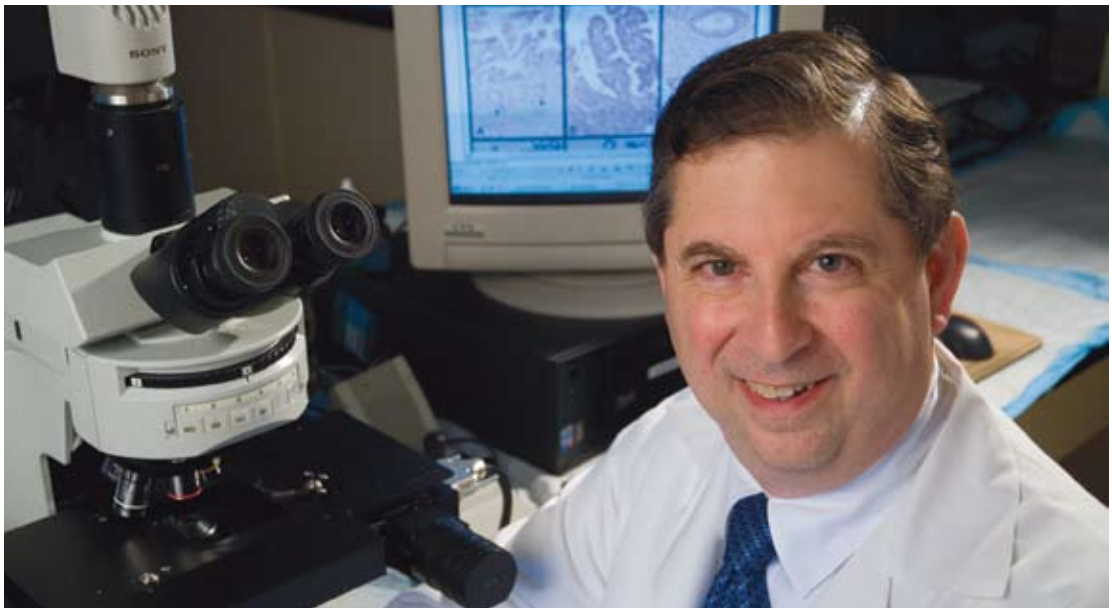
New Life Science Research Program Initiatives

This past year, CRI launched the Life Science Research Guest Lectutre Series which invites life science researchers from around the country to share research results with faculty and students at UNC Charlotte, neighboring universities, healthcare organizations and the life science industry in the Carolinas. The guest lecturers represent researchers in CRI's core life science research areas: cancer, liver, medical device and health services. One guest, Dr. Alphonse Sirica of Virginia Commonwealth University School of Medicine, delivered a lecture on liver cancer to UNC Charlotte and CMC's Cannon Research Center liver researchers.

Also, this past year, CRI launched a life science research grantsmanship series for faculty and students that recently hosted the American Cancer Society and N.C. Biotechnology Center.

In addition, CRI formed a partnership this year with the American Cancer Society of the Carolinas to support and promote cancer research in Charlotte.

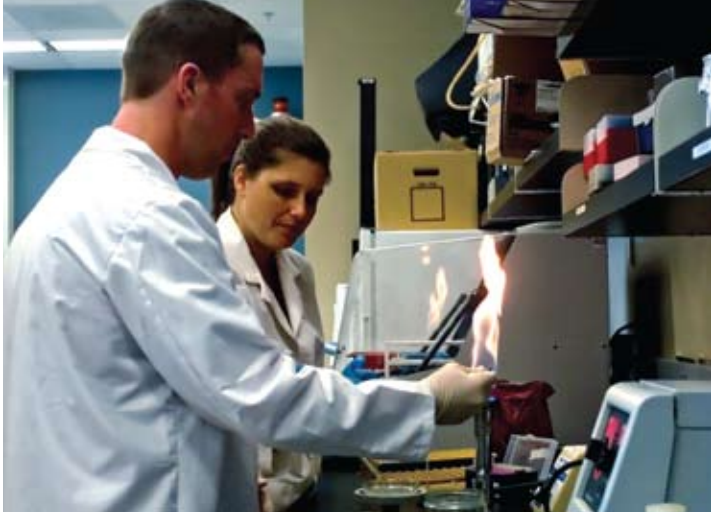
Over the last five years, external research funding in the Department of Biology has grown from $3 million to $10 million. Life Science Research in the Department of Biology involves biomedical research and environmental research (see also Cancer Research and Translational Research).



Above: Life Science Research Guest Lecture Series speaker, Dr. Alphonse Sirica, of the Virginia Commonwealth University School of Medicine.

College of Health & Human Services Builds NC Community Assesment Portal

Dr. James Studnicki, Irwin Belk Endowed Chair in Health Services Research, is building one of the best health services research programs in the country. His research tools enable community health and clinical assessments to be performed that for the first time are based on hard data. Dr. Studnicki is funded by the K.B.Reynolds Foundation to build the North Carolina Community Assessment Portal which will provide a community health assessment infrastructure for all 100 counties in North Carolina. The project is scheduled to deploy the system to a select group of health officials in August 2008.The second contract year will involve the addition of more databases to the warehouse and continuing expansion and refinement of system capabilities.



Colonization of Oysters To Study Food-Borne Disease

Bacteriologist, Dr. Jim Oliver (Biology) and oyster physiologists, Drs. Inna Sokolova (Biology) and Amy Ringwood (Biology) are funded by the U.S. Department of Agriculture to study *Vibrio vulnificus* in oysters to better understand the factors that allow this serious pathogen to cause human disease. *Vibrio vulnificus* is a bacterium occurring naturally in coastal waters around the world. It also causes the most fatal food-borne disease in this country, with a fatality rate exceeding 50%. Infection follows consumption of raw or undercooked molluscan shellfish, primarily oysters and clams. Most victims are males over the age of 40 who have some pre-existing, chronic disease such as liver cirrhosis, viral hepatitis, or an immune-compromising disease such as cancer. However, while the CDC estimates there are some 12-30 million Americans who have such diseases, the number of *V. vulnificus* cases generally does not exceed 100 per year in the US. A clue as to why so few cases occur, when so many people are susceptible, came when these researchers found that two genetic forms of the bacterium exist, only one of which appears to cause the disease. Most common in coastal waters is the "E" (environmental) type, while the "C" (clinical) form is the type associated with human cases. Also, while there are approximately equal numbers of E and C types in seawater, approximately 85% of the form occurring in oysters, the usual source for human infection, is the E type. The reason for this discrepancy is not known, but is one of the topics of this study. Whether the non-infectious E type is not taken up by oysters, or whether both are taken up by oysters, but only the E type survives, are two possibilities under investigation in this study. The researchers are also examining factors which would allow high numbers of the clinical form to occasionally be found in an oyster; ingestion of such an oyster may be sufficient to cause a fatal human infection. Finally, they are studying the genes of these two forms, to better understand the factors that allow this serious pathogen to cause human disease.

School of Nursing Faculty Receive Two Distinguished ANF Grants

This past year two faculty from the **UNC Charlotte School of Nursing** received the prestigious American Nurses Foundation (ANF) grants. UNC Charlotte School of Nursing was only one of two schools to receive more than one ANF grant. Dr. Margaret Wilmoth received funding to study the experiences of ovarian cancer patients related to sexuality, and Dr. Maren Coffman received funding to study the development and testing of the nutritional literacy scale.

Above: Post-Doctoral researchers Eric Binder and Melissa Jones in the laboratory of Dr. Jim Oliver.

Left: Dr. Margaret Wilmoth leads a class discussion.

Additionally, Dr. Coffman was awarded a North Carolina Research Campus Grant to study the feasibility and effectiveness of the Latino food and fun nutrition curriculum for low income Latina mothers and their children in North Carolina. This study will evaluate the feasibility and effectiveness of a Latino focused nutrition education and physical activity intervention with low income Latina mothers and their children. Specific aims are to determine whether the curriculum 1) can be successfully implemented with Latino mothers and their children; 2) increases participants' intake of fruits and vegetables; and 3) increases their participation in physical activity.

Above: Dr. Coffman, NCRC Grant recipient, studies the Latino Food and Fun Curriculum to benefit Latino mothers and children in North Carolina.

Exercise Physiology Research Laboratory Studies Genetics Influence on Physical Activity

The **Exercise Physiology Research Laboratory** within the Department of Kinesiology has enjoyed a productive and successful year. The Exercise Genomics Research Group, led by Drs. Tim Lightfoot and Mike Turner, has continued to study the genetic influences underlying physical activity as well as the effects of aging upon genetic factors in selected strains of inbred mice. This work, currently funded by the National Institutes of Health, is ultimately trying to understand what genes specifically regulate daily physical activity. Dr. Lightfoot and his research team were recently featured in the July 30th edition of the Health & Science section of Time.com. Under the leadership of Dr. Turner, his research group has been investigating the genetic influence on voluntary physical activity throughout the lifespan. Additionally, his research team has been studying the influence that daily physical activity has on age-related changes in body weight and cardiac function. His lab group has found that nearly 80% of voluntary physical activity is influenced by genetic background at certain age periods through the lifespan. Dr. Susan Tsivitse and her research team have been studying the influence of classic developmental signaling pathways on young and aged adult skeletal muscle stem cells (satellite cells) using physiological stimuli models of muscle injury. As an example, her group found that the Notch signaling pathway is up-regulated at day 3 of recovery following downhill running and corresponds with the up-regulation of muscle repair markers. She is currently working on determining the temporal relationship of expression between the Notch signaling pathway and other cell-to-cell signaling pathways following downhill running. Researchers from the **Exercise Physiology Research Laboratory** produced four publications during 2007-2008 in prestigious physiology and genetics journals.

Biodynamics Research Laboratory Studies Effects of Osteoarthritis

Under the direction of Dr. Mitch Cordova, the **Biodynamics Research Laboratory** enjoyed a successful 2007-2008 FY. Researchers Dr. Cordova, Dr. Tricia Hubbard, and recently graduated doctoral student, Dr. Charlie Hicks-Little have been engaged in a series of research projects investigating the effects of knee osteoarthritis on the somatosensory, vestibular, and visual control of posture, as well as the effects of this debilitating disease on lower extremity joint mechanics during stair climbing. Additionally, the laboratory has been studying the effects of ankle osteoarthritis on mechanical and sensorimotor function under the direction of Dr. Hubbard. This work has shown that both ankle and knee osteoarthritis negatively affect muscle strength as well as joint mechanics during static and functional tasks. Dr. Cordova and Dr. Mike Turner also completed a research project funded by Cybex International Corporation investigating the physiological outcomes of Cybex's ARC Trainer cardiovascular device in comparison to a leading competitor's elliptical machine. Researchers within the Biodynamics Research Laboratory received prestigious accolades during 2007-2008 as well. Dr. Tricia Hubbard was awarded the prestigious Freddie H. Fu, MD New Investigator Research Award from the National Athletic Trainers' Association – Research & Education Foundation and Dr. Mitch Cordova was elected Fellow of the NATA for his research accomplishments throughout his career. Researchers from the Biodynamics Research Laboratory published five manuscripts in high quality journals and made numerous national presentations.

Visit: **www.bioweb.uncc.edu** and **www.health.uncc.edu**

Left: Researchers in the Biodynamics Research Lab at the UNC Charlotte Department of Kinesiology, study the influence of knee and ankle osteoarthritis on lower extremity joint mechanics during stair climbing

Cancer Researcher from Mayo Clinic Joins UNC Charlotte Cancer Research Faculty

Pinku Mukherjee, Ph.D., Associate Professor of Immunology and Director of the Cellular Immunology Laboratory at the Mayo Clinic in Scottsdale, Arizona, joined the cancer research faculty at UNC Charlotte in September 2008. Dr. Mukherjee's research focuses on the development of efficient and targeted immune modulating therapies delivered directly to the tumor site in breast and pancreatic cancers.

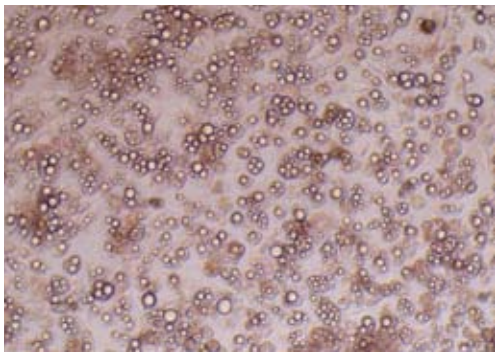
Dr. Mukherjee's career experience includes ten years at the Mayo Clinic Scottsdale preceded by previous research tenures at Indiana University Medical Center and Pennsylvania State University. She received her Master's and Ph.D. degrees in immunology from the University of London and her Bachelor's degree in microbiology and biochemistry from Bombay University.

Dr. Mukherjee was recruited to UNC Charlotte with assistance from the North Carolina Biotechnology Center using an Oliver Smithies Faculty Recruitment grant. Mukherjee will bring over $3 million in research grant funding with her when she joins the UNC Charlotte Department of Biology.

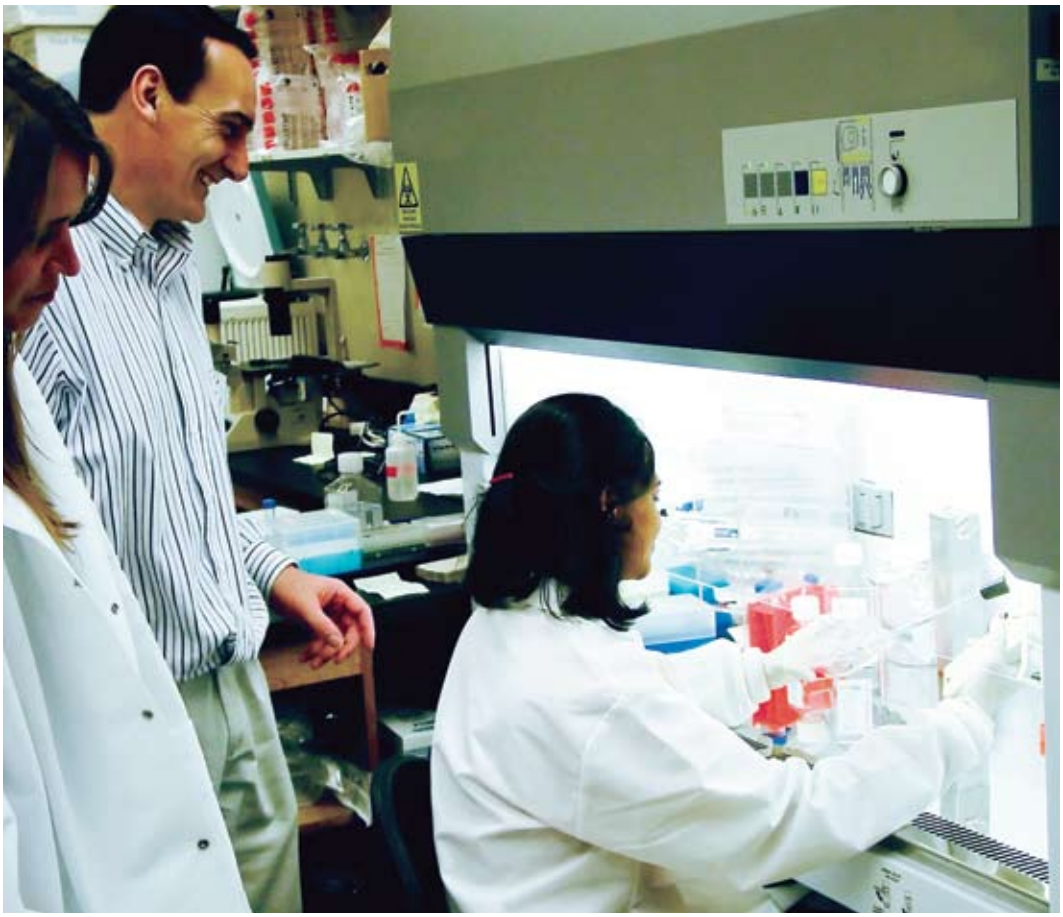
Cancer research at UNC Charlotte is a research area targeted for immediate growth. Presently, the Department of Biology has five faculty who are engaged directly in cancer research projects, with 12 additional faculty conducting research that is supportive and complementary to the cancer group. Research areas include breast, skin, lung and brain cancer along with cancer genetics and cancer genomics. UNC Charlotte and the Charlotte Research Institute are also planning the development of a multi-million dollar endowed brain cancer research program.

Circulating Promoters of Cancer Weight Loss

Dr. Lauri Byerly (Biology) is investigating the root cause of weight loss that occurs in cancer patients with funding from the American Institute for Cancer Research. More than 50% of cancer patients experience weight loss. Initially fat mass is lost followed soon after by loss of muscle mass, and it is difficult to stop the weight loss let alone cause weight gain. At one time, unexplained weight loss (termed cachexia) was the physician's first clinical sign of a growing tumor. Once cachexia occurs, the patient's life expectancy is shortened. This weight loss cannot be explained merely by a loss of appetite. Dr. Byerly's preliminary data suggest the presence of a specific protein(s) in a cancer patient's blood that appears during tumor growth that could be detectable before any observable weight loss. Dr. Byerly's work will identify this factor or factors using a well characterized tumor-bearing animal model of cachexia coupled with a cell culture assay that mimicks what physicians see in humans. Results of this project could lead to a better description of this protein(s) and ultimately to new therapies to prevent fat mass in nutritionally compromised cancer patients.



Right: Photo of 3T3-L1 adipocytes growing on a tissue culture plate used for cancer research.

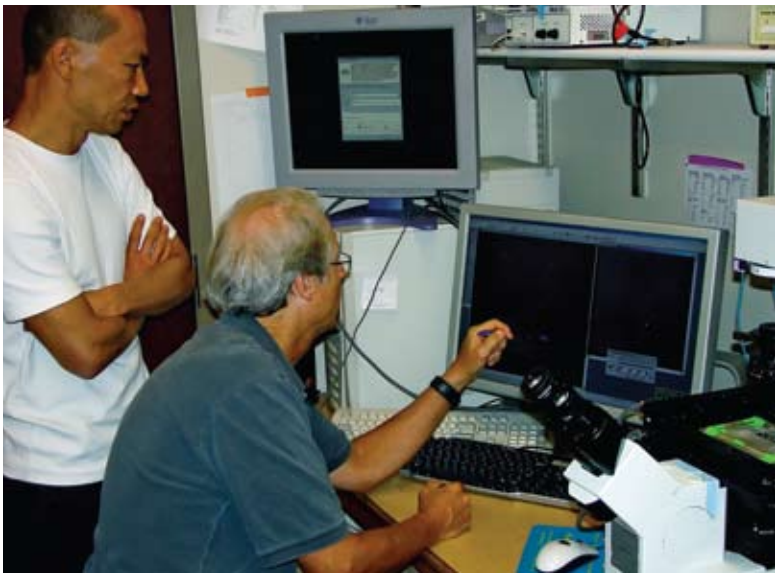


3D In Vitro Breast Cancer System Funded by NIH

Dr. Didier Dreau (Biology) was awarded funding from the National Science Foundation and Department of Defense to develop a 3D in vitro breast system in collaboration with Dr. Kathryn Burg (Bioengineering) of Clemson University. In the past five to ten years, 3D models using multiple cell types have been generated, but the field is not mature yet and each lab seems to have its own recipe. Drs. Dreau and Burg are developing standardized 3D culture models that will mimic breast tissue and the first steps of breast cancer with a long term goal of generating a breast tissue system with stable characteristics allowing for the testing of drug and individualized therapeutic protocols. A 3D breast tissue system will enable more accurate testing of new cancer treatments and therapies.

Visit: **www.charlotteresearchinstitute.com**

Above: The Lab of Dr. Didier Dreau was awarded research funds to develop a 3D in vitro breast system to improve testing of new cancer treatments and therapies



Above: Dr. Mark Clemens (right) and Dr. Charles Lee (left), of the liver recovery start-up company, HepatoSys.

Moving from Bench to Bedside in Medical Research

Working closely with clinical partners like the Carolinas Medical Center (CMC), UNC Charlotte researchers are accelerating their basic sciences research and driving new medical treatments.

One of the most promising examples of this research, building on the strengths of CMC and UNC Charlotte, addresses treatment of damaged livers. UNC Charlotte has five basic scientists studying different aspects of damaged liver recovery and bioartificial devices to support damaged livers awaiting transplantation. CMC is home to a robust liver-biliary-pancreatic center comprised of eight medical staff and eight researchers focused on liver injury and transplantation. Both organizations are committed to the development of a strong partnership and continue to expand their research staff and resources.

Early manifestations of this collaboration are found in several research efforts. Dr. Laura Schrum (UNC Charlotte) is Co-Investigator with Dr. Iain McKillop (CMC), Principal Investigator for an R21 National Institutes of Health (NIH) grant to study alcohol and liver cancer. Drs. Schrum and McKillop are also preparing a submission as co-Principal Investigators for an NIH grant to study apoptosis resistance in stellate cells. Dr. Schrum copublished a paper in FEBS (Federation of European Biochemical Societies) Letters with Dr. Herbert Bonkovsky (CMC) on alcohol and livers. [Tissue-specific expression of ALA synthase-1 and heme oxygenase-1 and their expression in livers of rats chronically exposed to ethanol , 08 May 2008, Jianyu Zheng (UNC Charlotte), Qing Tian, Weihong Hou (CMC), John A. Watts (CMC), Laura W. Schrum (UNC Charlotte), Herbert L. Bonkovsky (CMC). FEBS Letters, 1 June 2008 (Vol. 582, Issue 13, Pages 1829-1834)]

Dr. Mark Clemens (UNC Charlotte) and Dr. Charles Lee (UNC Charlotte), owners of the liver recovery start-up company, HepatoSys, have conducted research at the CMC Cannon Research Center, using the large animal vivarium. Their innovative liver preservation solution has the potential to increase the number of donor organs available for transplantation by 20-40%. This preservation solution along with the technology that relies on it — low temperature machine perfusion — promises to recover organs from donors that have undergone cardiac arrest. Since these organs are not transplantable and currently discarded, the work of this interdisciplinary team is expected to expand the pool of donated organs, thus increasing the organ supply available for medical emergencies. HepatoSys, Inc. has recently received a $1.4 million SBIR Phase II grant from NIH for preclinical testing with the liver. This project is a collaborative effort between HepatoSys, Inc. and the East Tennessee State University Quillen College of Medicine Transplantation Group.

Visit: **www.bioweb.uncc.edu**

UNC Charlotte Receives North Carolina Motorsports Association Award

The **North Carolina Motorsports and Automotive Research Center (NCMARC)** runs "flat out." Race teams and auto makers use our researchers in vehicle dynamics, aerodynamics, simulation, metrology and quality control and instrumentation.

Engineering expertise is an integral path to the checkered flag. UNC Charlotte has produced more than 80 engineers currently on professional race teams, more than a tenth of the industry's entire stock car race engineering workforce.

NCMARC modeling work is creating a revolutionary suspension geometry that can affect grip and speed on vehicles, whether on the track or the interstate. This assists vehicle efficiency and safety.

One of the largest US "water tunnels" is being created that enables researchers to understand fluid flow over surfaces, and helps designers create more efficient vehicle designs.

Water tunnels are used to enhance wind tunnel data by providing improved visualization of flow patterns. Although there are over a hundred recirculating water tunnels in the US, the fourth largest is under construction in the Motorsports Race Shop at UNC Charlotte. Besides all of the expected academic research projects planned for study in this tunnel, collaboration research projects have been initiated with NASCAR cup teams. Their interest is in the wake flows of drafting race cars running in packs. The 53,000 pound UNC Charlotte Recirculating Water Tunnel is expected to be filled with water December 2008.

For the second year in a row
UNC Charlotte received the North Carolina Motorsports Association's Four Year University Award.

NCMARC gets across the line first, but also "goes the distance." In addition to some of the worlds leading motorsports franchises, **NCMARC** consults with many other organizations and government municipalities to determine ways to make their vehicle fleets more fuel efficient.

For more information, please visit **www.MotorsportsU.com.**

Left: The 850 horsepower UNC Charlotte Drag Race Team "502 Big Block" mounted on the new DTS Engine Dyno.

UNC Charlotte Hosts Nanobiotechnology Conference

Nanotechnology is a field of applied science and technology that involves work with materials on a scale smaller than one micron (normally I to I00 nanometers). **Nanoscale Science** offers great potential for applications in materials, medicine, optics, electronics, data storage, advanced manufacturing, environment, energy and national security.

Nanoscale science is an interdisciplinary field involving chemistry, biology, physics, mechanical engineering, electrical engineering, and computer engineering to extend existing science and engineering disciplines. Nanotechnology at UNC Charlotte integrates these disciplines and includes the **Centers for Precision Metrology**, **Optoelectronics**, **Biomedical Engineering Systems** and **Bioinformatics**. The Nanoscale Science Ph.D. program at UNC Charlotte is beginning its second year and includes 13 full time students and 40 faculty members from across campus.

In fall 2007, the North Carolina Biotechnology Center, the University of North Carolina at Charlotte and Carolinas Medical Center hosted "Nanotechnology in Biology and Medicine," a one day conference on nanotechnology's potential impact on medicine. The speakers were physicians, clinicians, entrepreneurs and academics from an array of interrelated disciplines providing diverse perspectives on the rapidly evolving field of nanotechnology.

Highlights of the conference included: Don Ingber MD, Ph.D., Harvard University, lecturing on "Biological Design Principles for the Nanotechnologist," Molly Stevens Ph.D., Imperial College, London, UK, reporting on "Clinical Applications of Nanotechnology: Example in Tissue Regeneration and Biosensing," and Sebastien Lecommandoux, Ph.D., Professor, University of Bordeaux, presenting a tutorial overview (I00 attendees), "Soft Nanomaterials and their Applications in Biology and Medicine."

In the past year significant accomplishments have been made in the polymer nanotechnology lab under the leadership of Dr. Ken Gonsalves. With continued funding from Intel Corp and Rhom & Haas Electronic Materials Inc, progress has been made in achieving the 32 nm and lower feature nodes of the ITRS road map for next generation integrated circuits. Seed/initial funding for these breakthroughs was provided by SEMATECH INT, NSF and DARPA. Furthermore, through collaborations in computational lithography modeling with IMEC Greece and use of nanolithography EUV exposure tools at Lawrence Berkeley National Laboratory and the Paul Scherrer Institute in Switzerland, these significant milestones have been possible.

Visit: **http://nanoscalescience.uncc.edu**

Above (left): Professor Mohamad-Ali Hasan (right) and Professor Raphael Tsu (left) discuss atomic-level behavior observed by an ultra-high vacuum (UHV) scanning tunneling microscope (STM).

Above (right): Dr. Kenneth Gonsalves in the polymer nanotechnology lab.

UNC Charlotte Responds to Energy Engineering Needs

The electric energy industry faces a massive turnover in employee ranks as Boomers retire. Couple this with an expected 40% rise in electric consumption in roughly 20 years and the need for capacity and talent is extreme.

The Energy Production and Infrastructure Center (EPIC) is an industry-driven response to this national imperative. **EPIC** produces a technical workforce, innovation and strategic collaboration for a global energy industry while supporting the Carolinas' multi-state economic and energy security.

Some people call UNC Charlotte's **EPIC** initiative, "Energy East" – a contemporary energy center balanced aside the intensive hydrocarbon-based energy education elsewhere. Simply put, we produce the heads and hands for an energy-secure USA.

UNC Charlotte is the center of gravity in the coming wave of energy innovation as our graduates fan across global energy horizons to design, build and operate clean and safe power sources for the world.

UNC Charlotte received a total of more than $76 million to design and build the 200,000 square foot building that will house the **EPIC** R&D Center along with the Department of Electrical and Computer Engineering and Department of Civil and Environmental Engineering. Design will be completed during the 2008-2009 year with construction to be completed during the 2011-2012 FY.

Visit: **http://www.coe.uncc.edu/index.php**

EPIC, STARTED IN 2008, "POWERS-UP" GRADUATES A REGION RICH IN ENERGY KNOWLEDGE:

More than 100 highly specific "power cluster" firms make Charlotte the hub of energy knowledge and resources in critical industry skills – design, operations, engineering, research and construction.

Roughly 12% of the nation's nuclear energy is produced in the Carolinas.

The world renowned Electric Power Research Institute is ten minutes from campus.

Above: Dr. Robert Cox and graduate student Lalit Mandal discuss an ongoing experiment to develop a low cost, battery-monitoring system for use in vehicles.

Left: Maryam Nazemi, mechanical engineering student, utilizes a scanning electron microscope to examine ceramic components.

FY 2001:

WAVEGUIDE SOLUTIONS
Light-based devices for telecom and solid-state lighting

MINDVALVE
Business intelligence company focused on predictive analytics

OPSOURCE
Ultra-high precision machining company focused on aerospace, automotive and related industries

ALBANY INSTRUMENTS
Giant magneto-resistive (GMR) contactless probes and systems for buried crack detection

GOLGI GROUP
Biotechnology multi-media education company

NANORESIST TECHNOLOGIES
Next generation photoresists for semiconductor industry and biomedical applications

FY 2002:

ANALYTICA
Healthcare IT services and software products

INSITUTEC
Precision motion control products and services

MILLER INSIGHT
Small technology licensing firm in precision machining processes and methodologies

US METROLOGY
Precision metrology services and information firm

FY 2003:

HORIZON TECHNOLOGIES
Self-testing, self-healing semiconductor circuits

CALYPTIX SECURITY
Advanced network security products company

MIXSIG LABS
Advanced telecom circuits

INTEPOINT
Advanced, multi-platform, integrated intelligence analysis system

BIOTRACKERS
Advanced environmental testing products and services

FY 2004:

DOT METRICS TECHNOLOGIES
Quantum dot-based LED products for military and commercial applications

NOOR TECHNOLOGIES
Advanced photonic products for the telecommunications industry

FY 2005:

HEPATOSYS
Advanced biomedical products for liver organ preservation and transplantation

FLEXELERON
Portable FPGS-based "supercomputers" for point-of-use data mining

CIVIL INFRASTRUCTURE TECHNOLOGIES
Blast research, retrofit/hardening services and infrastructure security-based products

FY 2006:

SOYMEDS
Soy-based edible vaccines and toleragens for animals and humans

ENKIDU CRYSTAL
Advanced SiC technology for semiconductor substrates, epitaxial layers and related electronic/photonic circuits/components

ARETAE CORPORATION
Software solutions company

FY 2007:

PRECISION WOOD TURNING PRODUCTS
Novel tool manufacturer for the woodworking industry

FY 2008:

INFOSENSE INC.
Audio and wireless sensors utilized for detection and management of sewer blockages

VIRTUAL OFFICER
Interactive software to administer police lineups.

Charlotte Research Institute Board of Directors

Harry Arnold
Goodrich Corporation

Ronnie Bryant
Charlotte Regional Partnership

Gail Cassell
Eli Lilly and Company

Norman Cohen
Unitec, Inc

Kevin M. Drehmer
CRI Board Chair
Tessera NA

Dhiaa Jamil
Duke Energy Corporation

Michael Lebby
Optoelectronics Industry Development Association

Joan F. Lorden
UNC Charlotte

Stephen R. Mosier
UNC Charlotte

Paul Myers
AREVA NP Inc.

Anna Spangler Nelson
The Wakefield Group

Peter Sidebottom
Wachovia Corporation

G. Kennedy Thompson
Wachovia Corporation

Claudius Watts, IV
The Carlyle Group

Robert G. Wilhelm
Charlotte Research Institute
UNC Charlotte

CHARLOTTE RESEARCH INSTITUTE LOGO
Featuring Doric columns of ancient Greek architecture, the Charlotte Research Institute's logo is emblematic of the strength and stability of an established institution committed to its constituents. Further, the shadow of the columns in the image casts its influence forward, suggesting an arrow pointing toward the future.

Charlotte Research Institute
9201 University City Boulevard, Grigg Hall
Charlotte, NC 28223-0001
(704) 687-8284
www.charlotteresearchinstitute.com

Produced in November 2008 by the Charlotte Research Institute. XXXXX copies of this public document were printed at a cost of $X,XXX, or $X.XX per copy.

Grigg Hall, Room 258
9201 University City Boulevard
Charlotte, NC 28223-0001